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A Review of Current Graduate and Research Activities

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GRADUATE JOURNAL

A Review of Current Graduate and Research Activities

VOLUME V FEBRUARY 1957 NUMBER 6

Newly Discovered Works of Carl Philipp Emanuel Bach*

ELIZABETH S. DALLAS**

While conducting research in the Music Department of the Library of Congress, Washington, D. C., in November, 1955, the writer discovered seven works composed by Carl Philipp Emanuel Bach, the existence of which, previous to her disclosure in her A.M. Thesis, had not been recorded in history books or catalogues of Emanuel's works. These compositions exist in the Library of Congress in the form of handwritten manuscript copies of the parts only. Their titles, as they appear on the manuscript title pages, are:

1) "Concerto Cembalo, Violino Primo, Violino Secondo, Viola e Basso, Bach"
2) "Concerto, Cembalo—Concertato, Violino Primo, Violino Secundo, Viola è Basso, di Sig. Bach"
3) "Concerto Cembalo, Violino Primo, Violino Secondo, Viola e Basso, C. P. E. Bach"
4) "Sonata a 3 Strom: Flauto Traverso, Violino con Basso e Cembalo, D minor, Del Sigr. C. P. E. Bach, Màstro da Capella a Hambourg"
5) "Sonata E♯, 2 Violini e Basso, Bach"
6) "Trio, Flauto Traverso, Violino con Cembalo, Di Sigr: Bach"
7) "Sinfonia à 3 voc., Violino Primo, Violino Secondo è Basso di C. P. E. Bach."

The writer's first concern was to ascertain that these compositions were not recorded in any published listings or catalogues of Emanuel's works: i.e., *Carl Philipp Emanuel und Wilhelm Friedemann Bach und deren*

*This article is based on the author's Master of Arts Thesis, originally submitted in partial fulfilment of the requirements for the degree of Master of Arts in Boston University Graduate School, August, 1956.

**Mrs. Dallas is a Ph.D. candidate in the field of Musicology, studying under Dr. Karl Geiringer, Boston University.

Copr. 1957, Trustees of Boston University

Brüder, by C. H. Bitter, 1868; *Thematisches Verzeichnis der Werke von Carl Philipp Emanuel Bach (1714-1788)*, by Alfred Wotquenne, 1905; *Carl Philipp Emanuel Bach und seine Kammermusik*, by Ernst Fritz Schmid, 1931; "Philipp Emanuel Bach's musikalischer Nachlass," by Heinrich Miesner, in *Bach Jahrbuch, 1938, 1939, 1940-48;* and *Music of the Bach Family: An Anthology*, by Karl Geiringer, 1955. The most important of these books is the Wotquenne catalogue, for it is to this source that most past and present writers turn for an authoritative listing (usually quoted on the assumption that it is complete) of Emanuel Bach's works. The discovery of these seven works clearly indicates that the Wotquenne catalogue should not be accepted as a complete and final authoritative source, and Wotquenne himself states in the preface of his thematic catalogue that he is presenting it as a supplement to C. H. Bitter's book on the sons of Bach. The Wotquenne catalogue is a rearrangement of a thematic listing made by François Joseph Fétis (1784-1872) of the Emanuel Bach collection owned originally by Johann Jacob Heinrich Westphahl. This original collection and listing is now in the possession of the Brussels Conservatory. It does not record material that existed in the Singakademie, Berlin, the Preussische Staatsbibliothek in Berlin, nor undoubtedly numerous other places of location of Emanuel's works. This fact was wisely recognized by Dr. Geiringer; in his *Anthology* he carefully notes that the number of works cited is approximate. Unfortunately this qualification is not made in other history books and dictionaries.

None of the seven newly discovered works in the Library of Congress are listed in Bitter, Wotquenne, Meisner, and Geiringer. In the Schmid book, however, there is a short discussion of four sonatas that have not been authenticated as Carl Philipp Emanuel Bach works (pp. 119-121). Two of these sonatas are identical with two of the compositions in the Library of Congress. The titles of the sonatas, as Schmid quotes them from the title pages, are: "Sonata à E♯· à Trè, Flauto Traverso, Violino e Basso Continuo, Dell. Sign. C. P. E. Bach" and "Sonata in F♮: per il Flauto Traverso, violino e basso dell sig. C. P. E. Bach." Schmid states that a copy of the second sonata is in the Thulemeier collection of the Joachimstaler Gymnasium, Berlin-Templin, which has the title: "Sonata per il Cembalo Obligato overo violino, Flauto Traverso e basso dell Sign. Bach jun." Under the original title an addition of the name "W. Friedemann Bach" has been made in a later hand. An interesting fact disclosed by this writer's research is that this second sonata has been published by Broekmans & Van Poppel, Amsterdam, in 1946, edited by Hans Brandts Buys, and erroneously attributed to Wilhelm Friedemann Bach. In the preface of this edition Buys states that it is based on the copy of the sonata that is in the Joachimstaler Gymnasium (the second copy to which Schmid refers), and that it is the only (sic) copy in existence. The Library of Congress copy ("Trio, Flauto Traverso, Violino con Cembalo, Di Sigr: Bach") is a third copy of this work.

When referring to the number of concertos written by Carl Philipp Emanuel Bach, general music history books, dictionaries, and the previously mentioned references invariably attribute 52 concertos to him. This number is further supported by Bach's widow, Johanna Maria Dannemann Bach, in a letter written by her to Mrs. Sara Levy, quoted by Bitter. In this letter Bach's widow corrects a listing of his works that was made by Karl Bernhard Wessely, a family friend, and also states that Mr. Wessely's information concerning 52 concertos is correct. The disclosure of the existence of three concertos by C. P. E. Bach, in the Library of Congress, not previously known, repudiates the accuracy of such an exact statement. It further indicates that there is a widespread tendency among European musicologists to ignore the material or the possibility of the existence of material in American libraries. They would do well to adopt Dr. Geiringer's careful method of qualification.

According to the Library of Congress records, all of the unknown works under discussion were purchased from Leo Liepmannsohn, the famous music antiquariate in Berlin. They were offered in a special list of sixteen C. P. E. Bach manuscripts on May 1, 1907. They were ordered on May 20, 1907, and received at the Library on July 1, 1907. They were not accessioned, however, until 1908, at which time they were assigned the numbers from 105736 to 105752.

Six of the seven unknown works have a Grell collection number. Eduard August Grell (1800-1886) owned a large private collection of Bach family manuscripts. The intermediate owner between Grell and Liepmannsohn cannot be identified. Apparently the manuscripts were assembled from a variety of sources, probably by Liepmannsohn.

In an attempt to authenticate any composer's works, the tracing of records, as far as possible, is of primary importance. The determining factor, however, is identification of the work through stylistic characteristics.

C. P. E. Bach's creative life may be divided into three general periods — his early period in Leipzig and Frankfurt until 1738, the middle and transition period in Berlin from 1740 to 1768, and his late period in Hamburg from 1768 to 1788. The general development of his individual style is clear.

His early works written in Leipzig and Frankfurt reflect a definite influence of his father, Johann Sebastian Bach. Specific instances may be cited, such as the chaconne bass lines, strict harmonic cadences, a free development of structural elements of form, and "sigh figurations." The Berlin period shows the influence of the French *galant* element. Works from this period do not have a secondary theme; they have unity of one thematic idea and mood. Emanuel often uses "Lombard rhythm," voices frequently move in intervals of 3rds and 6ths, and unison passages are predominant. Mannheim suspensions occur frequently, as well as the expressive 7th chords. The instrumentation of works of this time favored the combination of the flute and

clavier. In the Hamburg period Emanuel's "sensibility" is most predominant. He frequently uses the Rondo form and the Fantasia. "Lombard rhythm" and Mannheim suspensions are no longer present.

The newly discovered works in the Library of Congress have each been analyzed in order to establish the existence of recognized stylistic characteristics of Emanuel Bach in them.

Concerto in e minor: constructed in the classical concerto formula, this work reflects the characteristic harmonic scheme of Emanuel Bach. The first movement conforms to sonata form, (i.e., structure of Exposition-Development-Recapitulation), but has only one theme for the entire movement. Unity of one thematic idea and mood is present. When the harpsichord is not playing a solo passage, it has a figured bass line. There are numerous passages in which all of the instruments play in unison. The movement has five different tutti passages and four solo passages. Sudden dynamic changes occur frequently. In the second movement, the material is treated in the concerto grosso style. The third movement is constructed in sonata form, having one theme. Stylistically this concerto can be placed in the early to middle Berlin period.

Concerto in A Major: constructed in the classical concerto formula, this work contains the characteristic harmonic scheme of Emanuel. The first movement, in sonata form, has one theme. Material from the theme is used by both the tutti and solo instrument exhaustively. The second movement is also constructed in sonata form, and has a single theme. Interchange of the material between the tutti and the solo instrument occurs frequently. Sudden dynamic changes as well as alternated *pizzicato* and *coll' arco* passages are present. There are four tutti sections in this movement. The third movement, in sonata form, has one theme. Frequent unison passages and sudden dynamic changes occur, as well as frequent unexpected rests. The bass is not figured at any time in this work. Freedom of form and especially idiomatic writing for the harpsichord is apparent. Judging from the stylistic characteristics, this concerto can be placed in the Hamburg period.

Concerto in g minor: this work is constructed in the classical concerto formula. The first movement, in sonata form, has one theme. The coda serves as a transition to the second movement. In the second movement there is only one theme, but it is constructed in the concerto grosso style. One thematic idea and mood is retained between the concertizing tutti and solo instrument. Sonata form is used for the third movement, with one theme. The figured bass in the first movement has chaconne bass elements. A few unison passages are used, but the writing is predominantly contrapuntal. The number of tutti passages used is very small. Sudden dynamic changes and alternated *pizzicato* and *coll' arco* passages occur frequently. These stylistic characteristics indicate that the concerto was probably written during Emanuel's Leipzig period.

Sonata a 3 Strom: this work is written for two melody instruments and figured bass. Its construction and harmonic scheme is characteristic of Emanuel. In character and spirit there is a definite unity of idea and mood. The first movement is in a free form and has one theme. The writing for the flute and violin over a figured bass is contrapuntal. The "sigh figuration" and sudden dynamic changes are predominant, and a chaconne-like bass is used. Free form is also used for the second movement, as well as for the third movement. The instrumentation of this composition — flute, violin, and figured bass — was a favorite combination of Emanuel's. Frequent appearance of the voices moving in intervals of 3rds and 6ths occurs. These stylistic characteristics place the work in the composer's Leipzig period.

Sonata in E Major: written for two melody instruments and bass, this work does not have a figured bass. The three movements are constructed in a basic AB form, and each one has a single theme. There is a marked unity of one thematic idea and mood. Mannheim suspensions are used, and the voices move in intervals of 3rds and 6ths. Sudden dynamic changes occur frequently. Stylistically the work can be placed in Emanuel's late Berlin period. The Library of Congress copy of this sonata is a second copy of the "unauthenticated" Sonata in E Major by C. P. E. Bach to which Schmid refers.

Trio in F Major: this work is written for two melody instruments and a fully figured bass. A free formal structure is used for the first movement, while the second and third movements have a basic AB form. There are no secondary themes in any of the movements, and there is a marked unity of one thematic idea and mood. The two melody instruments move almost constantly in intervals of 3rds and 6ths. Frequent "sigh figurations" and dialogue treatment of the material is present. The stylistic characteristics of this sonata indicate that it was written during the early Berlin period of Emanuel.

Sinfonia à 3 voc., D Major: although this work is titled "Sinfonia," it is actually a trio sonata. It is written for two melody instruments and a figured bass. In the first movement the sonata form is used; in the second movement there is no definite form; and in the third movement the Rondo form is used. Fantasia elements are apparent in the second movement, and this movement serves as a transition between the first and third movements. The "sigh figuration" is a fundamental characteristic of the work. A few unison passages are used, and sudden dynamic changes occur frequently. Judging from these stylistic characteristics this sonata can be placed in the late Berlin period.

The results of the writer's research and analysis have led her to ascertain that these seven compositions are authentic works of Carl Philipp Emanuel Bach and constitute an important addition to the known works of the composer.

Some Comments on Professor Siegel's Paper

NATHAN MACCOBY*

The Editor of the GRADUATE JOURNAL invited me to write a brief rejoinder to Professor Armand Siegel's challenging and stimulating article on the future role of the graduate school in training college teachers, which appeared in the January, 1957 issue of the JOURNAL. Since I find myself in agreement with many of Professor Siegel's observations and suggestions, I would prefer to regard what I have to say as being in the nature of comments rather than as a rejoinder.

Dr. Siegel argues that with the tremendous increase in college enrollments facing us in the near future, that if graduate schools continue to be the primary source of training college teachers, our graduate schools will be swamped and the main scholarship and research function of graduate training lost. He further argues that college teaching is a distinct profession and that separate professional schools should therefore be set up to train the large numbers needed. Just as schools of education took over the job of training high school teachers from colleges of liberal arts, he feels that the time is soon coming when separate professional schools should train the teachers of undergraduates.

Certainly the problem is of serious magnitude and the statement of it highly timely. The problem of the role of the graduate school in professional training is a genuine one. At what point should separate professional schools be set up to provide professional training? This has happened not only in the case of law, medicine, and dentistry, but also in most instances, in nursing, social work, business and public administration, journalism, communications, and public relations, as well as in other areas.

I propose tentatively that the following criteria be considered appropriate for the establishment of separate professional schools:

1. When the knowledges needed and the professional skills required become highly specialized.
2. When these deviate sufficiently from the main body of academic scholarship.
3. When the numbers to be trained become substantial.

When these criteria are met, the establishment of separate professional schools is needed both for the professions concerned and to protect the core disciplines out of which these fields emerge as applications. The question facing us is: "Does college teaching fit these criteria?".

Let us take them one at a time.

1. I question very seriously whether the knowledge needed and the professional skills required for college teaching are highly specialized ones. The knowledges needed are precisely the ones which constitute the academic fields themselves. I would grant unquestionably that some professional skills are needed for successful teaching. I question how specialized these are and how extensive a body of skills they constitute. It seems clear to me that these skills can be imparted without devoting a major portion of the graduate curriculum to this acquisition. In fact, I suspect that the most important skills for college teaching are a high degree of knowledge of the

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subject matter and a great enthusiasm for it. There are other skills, but I repeat that the acquisition of these need not constitute a major part of the graduate curriculum.

2. Do the knowledges and skills required for college teaching deviate sufficiently from the main body of academic scholarship? On the contrary, my view is that they are indissolubly linked with academic scholarship. Although the University is no longer, if indeed it ever was, the sole locus of research and scholarship, it certainly is still the main site where new knowledge takes place. The college and university teachers are still, and are likely to continue to be, the main sources of such new knowledge.

Now how about our third criterion? Are the numbers needed reaching a substantial size? Here, the issue is less clear. Certainly the need for trained college and university teachers is increasing drastically and poses a serious problem. I wonder, however, if there is not an alternative solution to turning away from the graduate school as the principal source. The higher education process needs to be seriously studied. Are there more efficient ways of utilizing the time and talents of skilled professors than is the current practice? Do we need to increase the instructional staff in direct proportion to the increasing number of students? I suspect that such intensive study would uncover ways in which college teaching can be considerably improved and teaching hours reduced without proportional increases in instructional staff.

There is, as Professor Siegel suggests, a great danger of our graduate schools becoming professional training grounds at the expense of training scholars. I suspect, however, this danger comes more from the slowness with which applied professional fields branch off from their core disciplines. This lag can well have the effect of stifling the proper growth of basic knowledge and the proper training of future scholars. I do not feel, however, that college teaching is one of these.

Record of Research—XXIX

The following list of books, articles, and records published recently by members of the University staff or by students was compiled from information made available in the office of the President of the University and of the Dean of the Graduate School.

Aerial Photography

MACDONALD, DUNCAN E. & JOHN T. WATSON. "Detection and Recognition of Photographic Detail. I. Empirical Data Applicable to the Prediction of Performance of Diffraction Limited Systems," *J. of the Optical Society of Amer.*, Vol. 46, No. 9, September, 1956, pp. 715-20.

Biochemistry

OFODILE, ANSELM A., MOIRA DAVISON REYNOLDS, & BURNHAM S. WALKER. "Succinic and Malic Dehydrogenases in Serum," *The Amer. J. of Clinical Pathology*, Vol. 26, No. 7, July, 1956, pp. 765-70.

Biology

DEGELMAN, JOHN. "A Strain-Gage Pneumotachograph," *Electroencephalography and Clinical Neurophysiology J.*, Vol. 8, No. 3, August, 1956, pp. 517-20.

[*Continued on p. 92*]

Micro-reproduction in the Chenery Library

ROBERT E. MOODY

Professor of History
Director of University Libraries and Museums

In the June, 1952, issue of the GRADUATE JOURNAL, I described briefly the various agencies now engaged in providing micro-reproductions to libraries. In later issues occasional mention has been made of micro-reproduced titles owned by the Chenery Library. Increasingly, materials in this form have been accepted for use by the students; indeed, there is no alternative, they would not otherwise be available.

In general, it may be said that the machines for reading are adequate. Conditions for use in the Chenery Library, however, do not allow a fair test of quality of our present machines. This problem is being studied in the hope of cutting down some of the unwanted light. The material is, however, being used with success.

It seems desirable, therefore, to give some brief account of the micro-reproduced items now available for use in the Chenery Library.

As will be seen from what has been written here, micro-reproduction offers a remarkable saving in space which is of particular advantage in the case of extensive series of documents, newspapers, and periodical files. For documentary series, microprint has more advantages than microcards. For newspapers, microfilm is still the most successful form of reproduction. Periodical files are available on both film and microcards. So far as the economies of book publishing is concerned, a convenient rule of thumb is:—

1-12 copies	microfilm is cheapest.
12-50 copies	microcard is cheapest.
over 50 copies	microprint is cheapest.

Another saving of importance is in bindery costs. In the case of newspapers, microfilm has overwhelming advantages, not only because of its saving in storage and bindery costs, but also because wood pulp newsprint disintegrates so fast that, in a few years, newspapers in their original form simply could not be used without falling apart. Most, but not all, periodicals are printed on paper of a fair quality, but the cost of binding alone is approaching the cost of microfilming. The storage cost is the deciding factor at present. Studies of costs are not conclusive since there are variables which enter into the analysis of the problem.

The microfilming of theses is as important to university clienteles as any phase of this subject. The University Microfilms project with its printed abstracts "unfreezes" an enormous "frozen asset" by making theses universally available at a reasonable cost. Inter-library loans are eliminated by this program, thus further reducing the expenses incidental to scholarship.

In its purchases so far, the Chenery Library has made only a

small beginning, and titles are being made available at an increasing rate. Fortunately the interest in micro-reproduction has been such that consolidated lists have been printed and these will undoubtedly be kept up-to-date. The chief lists are as follows:

Union List of Microfilms

Microfilm Abstracts

Eastman Kodak Co. — *What's Available on Microprint Cards*

Supplements to Library of Congress *Information Bulletin*

A representative, though not complete, list of our holdings is given here.

Microfilm

New York Times, 1948 to date

Washington Daily National Intelligencer, December 20, 1859-January 16, 1866

Mayhew, Jonathan (1720-1766) Eight manuscript sermons, 1750-1764 (Huntington Library)

Wilson, Henry (1812-1875) Papers (Library of Congress)

Fort Warren, Papers Relating to (Southern Collection, University of North Carolina)

MacGill, Charles, Papers, 1861 (Duke University)

Tugwell, Rexford G. Papers Concerning R. G. Tugwell (Franklin D. Roosevelt Library, Hyde Park, N. Y.)

Voice of Industry Vol. 1, no. 1 — Vol. 3, no. 5: May 29, 1845-December 31, 1847

Rogers, Edward H. (1824-) Selections from Papers (State Historical Society of Wisconsin)

U. S. Dept. of State, Despatches from U. S. Ministers to France. Nos. 1-5: September 30, 1789-December 30, 1790 (National Archives)

Notes from French Legation in U. S. to Dept. of State vol. 1: June 7, 1789-March 1, 1805

About 130 microfilms of books and theses from other libraries otherwise not obtainable

Life filmstrips

A dozen B. U. theses

Microcards

We have on microcards a substantial part of the Library of Thomas Jefferson (Library of Congress). These give not only an insight into the character and extent of Jefferson's reading but the volumes themselves represent a very considerable section of the great literature, particularly in the political field, of that era. There is a catalog of the Jefferson Library, by E. Millicent Sowerby, which is a superb guide to these volumes.

Many books are available on microcards. We have a small group and expect to increase our purchases.

Microprint

U. S. Congress
Serial set vols. 1-123, 15th to 18th Congresses: December 1, 1917-March 3, 1825. 4 boxes.

Great Britain Parliament, House of Commons
British Sessional Papers, 1810-1900. 250 boxes. (These are the equivalent of 80,000 documents or 6,000 printed volumes — equivalent to 4,000,000 pages.)

United Nations
Atomic Energy Commission (1946-1951). 1 box.
Disarmament Commission (1952-1953). 1 box.
Economic and Social Council (1946-1953). 16 boxes.
General Assembly (1946-1953). 12 boxes.
Security Council (1946-1953). 4 boxes.
Trustees by Council (1947-1953). 7 boxes.
The entire set, 1946-1953, will occupy about 12 feet of shelf space compared with 300 feet of ordinary print.

Three Centuries of Drama. 5,000 plays; English Drama, 1500-1800; American drama to 1830. There is a printed catalog.

[*Continued from p. 89*]

Record of Research—XXIX

Mathematics

BLACKETT, D. W. "The Near-Ring of Affine Transformations," *Proceedings of the Amer. Mathematical Society*, Vol. 7, No. 3, June, 1956, pp. 517-19.

Music

GEIRINGER, KARL. *Music of The Bach Family*, "Boston University Anthology of Recorded Music," released by Boston Records, Boston, Massachusetts. Complete boxed set, 4 LP's with analytical notes by Karl Geiringer, $21.02.

Physics

AJZENBERG-SELOVE, F., G. D. JOHNSON, M. MAZARI, & A. RUBIN. "Neutrons from the Proton Bombardment of B^{11}," *The Physical Review*, Vol. 103, No. 2, July 15, 1956, pp. 356-7.

SIEGEL, ARMAND. "Stochastic Basis of Onsager's Minimum Principle," *The Physical Review*, Vol. 102, No. 4, May 15, 1956, pp. 953-9.

Psychology

HARRISON, J. M., & W. H. TRACY. "Aversive Behavior Following Lesions of the Septal Region of the Forebrain in the Rat," *The Amer. J. of Psychology*, Vol. LXIX, September, 1956, pp. 443-7.

Statistical Research

NOETHER, GOTTFRIED E. "Two Sequential Tests Against Trend," *J. of the Amer. Statistical Assoc.*, Vol. 51, September, 1956, pp. 440-50.

Boston University Book Reviewed

The Chemicals of Life, by Isaac Asimov.* New York: Abelard & Schuman, Inc., 1954, 159 pp., $2.50.

Reviewed by HAROLD P. KLEIN**

Dr. Asimov is a remarkable man. After achieving a high degree of success in the science fiction field, and, after writing textbooks of biochemistry, he has now turned his attention and energies to a most difficult challenge. In *The Chemicals of Life*, he makes a gallant attempt to stimulate, in the younger generation, an interest in the subject matter of biochemistry.

To attain this end, the author writes with warmth and enthusiasm, and he even manages to infuse a certain quality of excitement and suspense into much that he writes about. The reader cannot help feeling that the author is on intimate terms with his subject matter. Indeed, Dr. Asimov conveys the impression that biochemistry is just about the most important and interesting thing in the world. Undoubtedly, this makes for easy reading. Young people interested in learning about this field probably will find no more readable text. In addition, the drawings by John Bradford — while highly diagrammatic — are, in the main, useful in illustrating many of the basic principles discussed in the book.

As with most books of this type, there is throughout a general tendency to state as fact much that is still unsettled. Attacking such problems as "how mitochondria work," "how an enzyme works," "how vitamin D is made," and "how chromosomes split up and re-unite," for example, Dr. Asimov must be given credit. For these are extremely complex matters and, in many cases, certainly not well understood today. Whether sweeping generalizations, which must be made if the lay reader is not to be confused by a mass of detail, are proper in a work of this type is a matter of debate. The author evidently must feel that, in this case, "the end justifies the means," because he is trying here to introduce a complex and difficult subject with a minimum of equivocation. To illustrate this point here are just a few examples: On page 2 is the statement "Viruses are so small that bacteria are giants in comparison." Most authorities would agree that there is a considerable range in the size of viruses and, while the author's statement is true for many, there are also viruses that approximate the size of some of the smallest bacteria. Also, in the succeeding paragraph is the statement (about viruses), "Here, it would seem, we have gotten down to pure life without any trimmings at all, *and it is protein*" (author's italics). In this case, of course, there is ample evidence, from the work with bacterial viruses, that the protein portion of these particles plays a subsidiary role to the nucleic acid portion.

The danger in oversimplification is obvious. The innocent reader, if he is willing to accept any segment of the book because it seems reasonable to him, will probably take on faith any other part of the book. Statements like "Every chromosome is actually a chain of protein molecules which are called GENES" (page 44) are completely misleading, if not incorrect. Later, in discussing the energy metabolism of organisms, the author says, on page 78, "The ATP

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molecules can be stored and hydrolyzed whenever needed... The muscles, in fact, contain a special enzyme called ADENOSINE TRIPHOSPHATASE, whose only job is to hydrolyze ATP whenever energy is needed." This can only be interpreted as meaning that, whenever the organism needs energy for some process, energy released by hydrolysis of ATP is somehow used by the cell. While there is no question that ATP serves as an energy donor, the picture presented by the author — in the interest of clarity — is so obscure as to be virtually useless.

Perhaps the most serious oversimplification is the name of the book itself. The complete title is, *The Chemicals of Life. Enzymes, Vitamins, and Hormones*, and the uninformed reader will undoubtedly assume from this title, and from the ensuing discussion of these substances, that they are truly *the* chemicals of life. Nowhere in the book — not even in the index — is there any mention of nucleic acids. And this despite the fact that Dr. Asimov is himself an investigator of nucleic acid biochemistry! Why these *truly fundamental* life chemicals were omitted from consideration in this little book is a mystery indeed.

"The Control of Small Blood Vessels"

GEORGE P. FULTON and BRENTON R. LUTZ

The following article is the first of a series of descriptive summaries of films produced in the Department of Biology and available for distribution, to be published in the JOURNAL.

One reel (482 feet) 16mm silent monochrome film with titles. Pictures were taken at 16 frames per second. Film should be shown at the same rate for actual time relationships. Running time 20 minutes at 16 frames per second.

The film illustrates both the structural and the physiological features of arterioles, precapillaries, and capillaries. Cinephoto-micrographic records are shown at magnifications from 60 to 900 times.

The distribution of the contractile elements, the non-contractile elements, and the perivascular nerve plexus is demonstrated, using the small blood vessels in the retrolingual membrane of the frog, Rana pipiens. The major portion consists of records of the vasomotor responses to stimulation of small nerves with a micro-electrode. The blood vessels, the nerve fibers, and the micro-electrode are always included in the same field.

The following morphological features are demonstrated in preparations stained differentially with methylene blue:

1. The distribution of the perivascular cells, including typical smooth muscle, modified smooth muscle of the vascular sphincters, and various pericapillary elements.
2. The structure and distribution of the perivascular nerve plexus.

The following physiological phenomena are demonstrated:

1. The diphasic vasomotor response, dilation followed by constriction.
2. Dilation alone with a weak stimulus.
3. Contraction in a limited vascular pattern (the motor unit).
4. Spontaneous rhythmic activity.
5. The non-contractility of the endothelium and certain precapillary cells.

6. The local control of capillary blood flow by the independent activity of the contractile perivascular elements serving as a vascular sphincter at the capillary origin.

1st sequence. Circulation in the living retrolingual membrane (x60)

The unique advantages of the retrolingual membrane for observations on the neuro-motor mechanism of small blood vessels are apparent. The membrane is the uninjured outer wall of a lymph sac. It contains skeletal muscle cells, blood vessels, and nerve fibers, arranged in a thin transparent layer, and enclosed by two layers of epithelium. An arteriole and its capillary branches may be seen with a small nerve fiber running parallel with it. The characteristic arrangement of the single skeletal muscle fibers does not obscure the blood vessels. As the preparation is moved beneath the microscope a continuous pathway may be traced from the arteriole through the capillaries to a venule.

2nd sequence. Arrangement of the perivascular elements (x200, x400).

In a preparation stained differentially with methylene blue, the distribution of the perivascular elements is demonstrated. The arterioles and precapillaries possess typical circularly-arranged smooth muscle cells. Certain capillary origins possess modified obliquely-arranged smooth muscle cells of the vascular sphincters. Beyond their origin, capillaries possess various longitudinally-arranged precapillary cells.

3rd sequence. The perivascular nerve plexus (x200).

In a preparation stained differentially for nervous tissue with methylene blue, the structure and distribution of the perivascular nerve plexus are seen. The arterioles possess a copious finely-meshed plexus, which is supplied at intervals by non-myelinated nerve fibers from a gross, primary plexus. The perivascular nerve net may be traced as far as the capillary origins, but becomes sparse on the capillaries. Sufficient nervous tissue is present to innervate each contractile element, although actual nerve endings are not detected.

4th sequence. Dilation and contraction, the diphasic response (x60, x100, x250).

In the living membrane, the micro-electrode is seen on a small nerve, which is stimulated with a brief faradic current. The appearance of the minute dark spot (hydrogen bubble) at the tip of the electrode marks the moment of stimulation. Stimulation is terminated when the bubble ceases to increase in size. The arteriole and precapillary first dilate and then constrict. The capillary is not actively involved.

5th sequence. Diphasic response of a precapillary (x360).

The micro-electrode is on a nerve. Stimulation is indicated by the appearance of the bubble. The arteriole and the precapillary dilate slightly and then constrict. The muscular activity of the precapillary is strikingly evident at its origin from the arteriole.

6th sequence. A control experiment (x150).

The micro-electrode is placed on the epithelium near a small nerve, but not in contact with it. Stimulation (appearance of bubble), produces no response. The electrode is then placed directly on the nerve and the same weak stimulus is repeated. Dilation occurs in the arteriole, precapillary, and capillary origin.

7th sequence. The effect of strong stimulation (x150).

The micro-electrode is placed on the same nerve as in the previous sequence. Strong stimulation produces constriction of the same arteriole, precapillary, and capillary origin. Note that the capillary origin constricts

at a different rate in a sphincter-like manner, serving as a vascular sphincter.

8th sequence. The effect of weak stimulation (x100).

This scene illustrates an occasional case in which the muscular blood vessels are found in a completely constricted state. Weak stimulation of a small nerve produces dilation, after which the vessels return to their original condition.

9th sequence. The capillary sphincter-mechanism (x150, x250).

The micro-electrode is on the wall of a capillary. The twitch of a nearby skeletal muscle fiber indicates stimulation with a single shock. A sphincter-like constriction takes place at the capillary origin, independent of the supplying arteriole. Note that the portion of the capillary in contact with the electrode does not constrict. Presumably, the response results from conduction in the perivascular nerve plexus.

10th sequence. An inert pericapillary cell (x900).

The micro-electrode is placed on a pericapillary cell. Strong stimulation produces no response of this cell or the endothelium, as is evident when the micro-electrode is moved from the point of stimulation.

11th sequence. The responses of three capillary origins (x200).

The micro-electrode is placed on a nerve near the upper edge of the microscopic field. Stimulation is indicated by the appearance of the bubble. The arteriole and the three capillary origins first dilate, then constrict. Note that the capillary origins constrict at different rates. Their activity is somewhat rhythmic.

12th sequence. Constriction confined to a capillary origin (x600).

The micro-electrode is placed on a nerve. Stimulation with a strong faradic current produces a constriction confined to the capillary origin. The supplying arteriole is not affected. Note the nuclei on the wall of the responding capillary origin.

13th sequence. Induced rhythmicity of a capillary origin (x600).

The micro-electrode is placed on a nerve near the right-hand edge of the microscopic field. Stimulation produces a rhythmic response of the arteriole and the capillary origin. Note the sphincter-like contraction of the pericapillary cells at the capillary origin. The capillary remains open beyond this point.

14th sequence. Spontaneous rhythmicity confined to a precapillary (x200).

This scene illustrates spontaneous rhythmic contraction confined to a precapillary. Note the small nerve running parallel to the precapillary. This nerve will be stimulated in the following sequence. Spontaneous activity occurs in preparations in which all the extrinsic nerves have been severed. The discharge of ganglion cells is not a likely explanation for the rhythmicity, since none is found in methylene blue preparations of the retrolingual membrane.

15th sequence. The effect of nerve stimulation on a rhythmic precapillary (x200).

The micro-electrode is placed on the nerve running parallel to the same precapillary which constricted rhythmically in the previous sequence. Stimulation produces constriction confined to the same precapillary. Note that the arteriole and the capillary are not involved in the response.

16th sequence. Spontaneous sphincter-like activity of a capillary origin (x600).

This scene shows spontaneous rhythmic activity of an arteriole and a capillary origin. The capillary origin contracts in a sphincter-like manner. Note the nuclei of the contractile cells here, and the nerve fibers nearby.